

730-1. File Copy

**The New  
Gas Works at  
Lynchburg,  
Virginia.**



[Reprinted from "Progressive Age," October 1, 1904.]



We take pleasure in handing you herewith pamphlet covering article by Mr. F. H. Shelton as published in the "Progressive Age," issue of October 1st, 1904, giving a description of the new gas plant erected in Lynchburg, Va., and of the benches installed therein.

We wish to call attention to Mr. Shelton's statement on page 7 as to the construction and operation of these inclined benches designed and erected by this Company.

For the Lynchburg installation Mr. Shelton requested plans and estimates from us for construction of benches with outside producers, also charging hoppers, limiting us only to an approximate height of the stack over all, and stipulating that a forced draught should be used, but in every other way leaving us free to design and construct the benches and install the generators and charging hoppers in such manner as we deemed best.

As this is the first installation of inclines built by us, we are greatly gratified that it should have turned out so well.

It is interesting to note that these benches are making 75,000 feet each. Retorts measured on the slant are 12' 9" long. This would equal in make for a bench of 6's with 9' retorts set horizontally over semi-recuperator furnaces, 52,000 feet, which for this grade of coal is very excellent.

We understand that these benches for a time produced 85,000 feet each, per 24 hours. The heats were reduced, however, as that quantity of gas was not required.

In reference to the article by Mr. Shelton. It sets forth that about one-third of the coke made is required for fuel. It is interesting to note, however, that this also covers the fuel required to operate the boiler as well as the benches, and, as a matter of fact, when you consider that these benches have half-depth recuperators, they show as great fuel economy as any semi-recuperator benches in operation. With furnaces under them and with full depth recuperation we are satisfied that the economy of operation as to fuel would be as great as in the best installations of horizontal benches, with a decided advantage in cost of labor for operating.

We are prepared to furnish plans and estimates and make tenders for the construction and erection of such plants of inclined benches either with outside producers, or furnaces under the retorts; also all machinery connected with the installation, including conveyers, charging hoppers, also retort houses, bins, etc.

We also design and construct horizontal benches of every description.

Very truly yours,

PARKER-RUSSELL MINING & MFG. CO.



[BLANK PAGE]



CCA







By

**Frederick H. Shelton.**

Consulting Gas Engineer  
1003 Pennsylvania Building  
15 and Chestnut Streets  
Philadelphia, Pa.



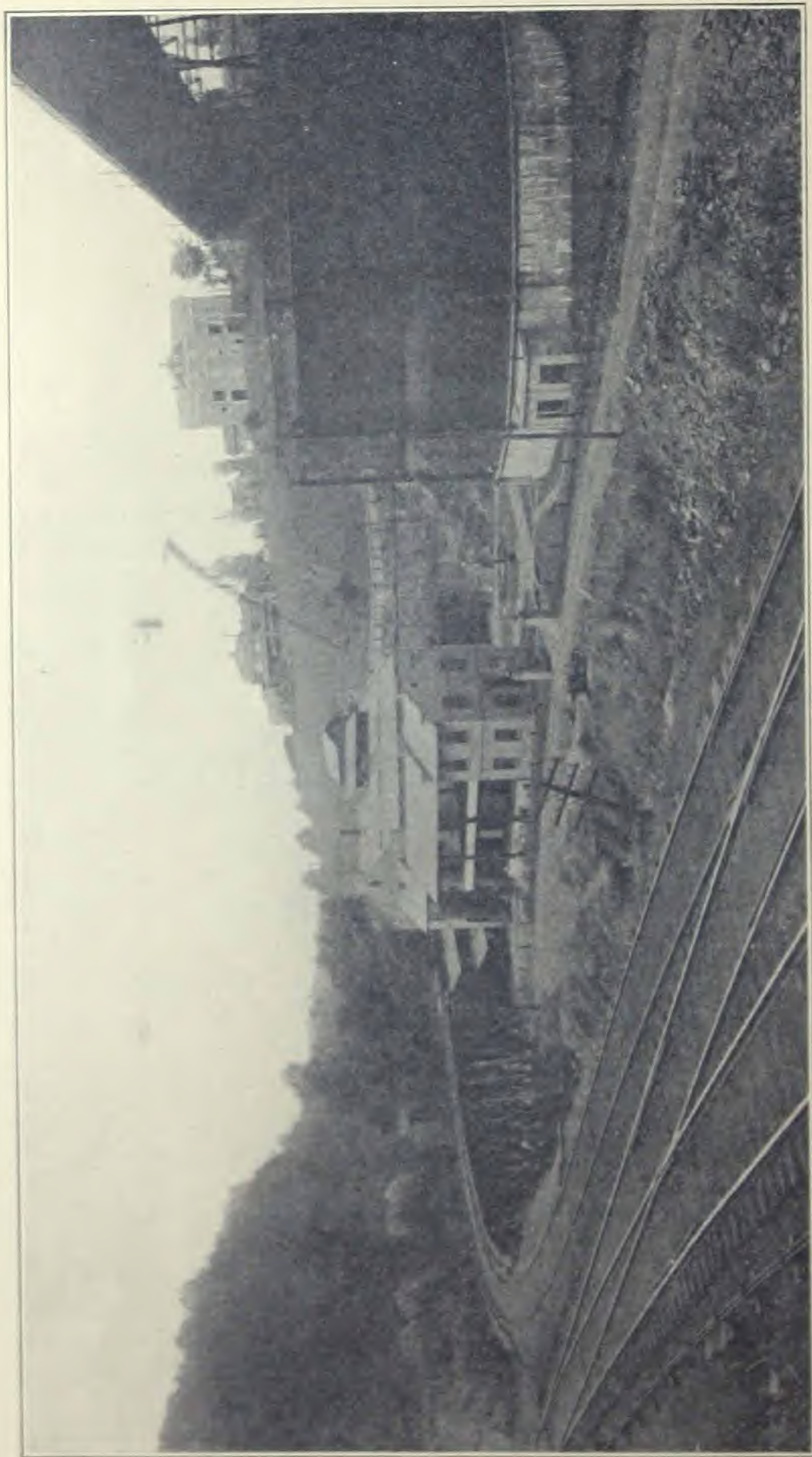


FIG. II. GENERAL VIEW OF NEW GAS WORKS AT LYNCHBURG, VA.



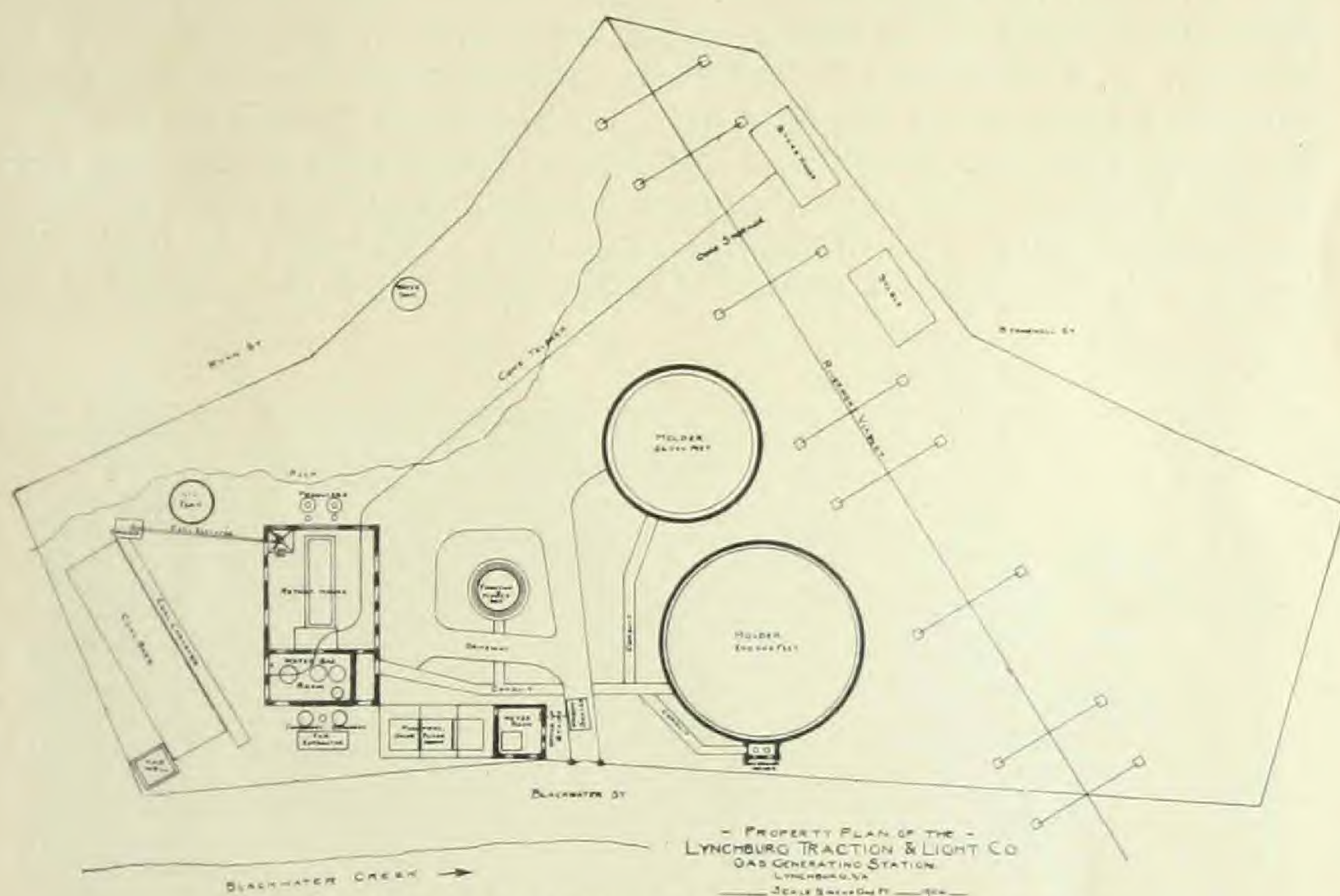


FIG. I. MAP OF PROPERTY AND PLAN OF WORKS.

## New Gas Works at Lynchburg.

By F. H. Shelton.

About a year and a half ago the Lynchburg Traction and Light Company, operating the gas, electric street railway and water-power properties in Lynchburg, Va., found itself in the position of either having to expend considerable further money upon a works already over fifty years old and having several unfavorable site features, or of selling the site to the railroad interests and the construction of an entirely new plant on new premises. It elected to do the latter and the resulting works, comparatively recently finished, it is the purpose of this article to describe.

*Works Site.*—In the selection of a new location the company was peculiarly handicapped, owing to the fact that Lynchburg is located wholly on the steep hills of the upper James River section and level ground is almost unknown. To have gone to the outskirts of the city would have meant long and expensive trunk lines and the giving up of railway facilities. The opposite river bank is but a rocky bluff and to locate anew the company had to finally occupy—not that it was desirable, but the best that could be had—an irreg-



ular triangular-shaped piece of ground of three acres, located in the gorge of Blackwater Creek, of which but one-fifth was level. This location had high rocky hillsides on one side, with high-class residences near, a rushing creek on another, a water runway through it, a viaduct 140 feet high running right over it (with legs and piers preventing the free use of what space there was) and city building laws that prohibited any frame structures within 200 feet of the viaduct. Its advantages, however, were firm rock foundations, good water and drainage, a low level, the two principal railroads adjacent and nearness to the centre of the street-main system.

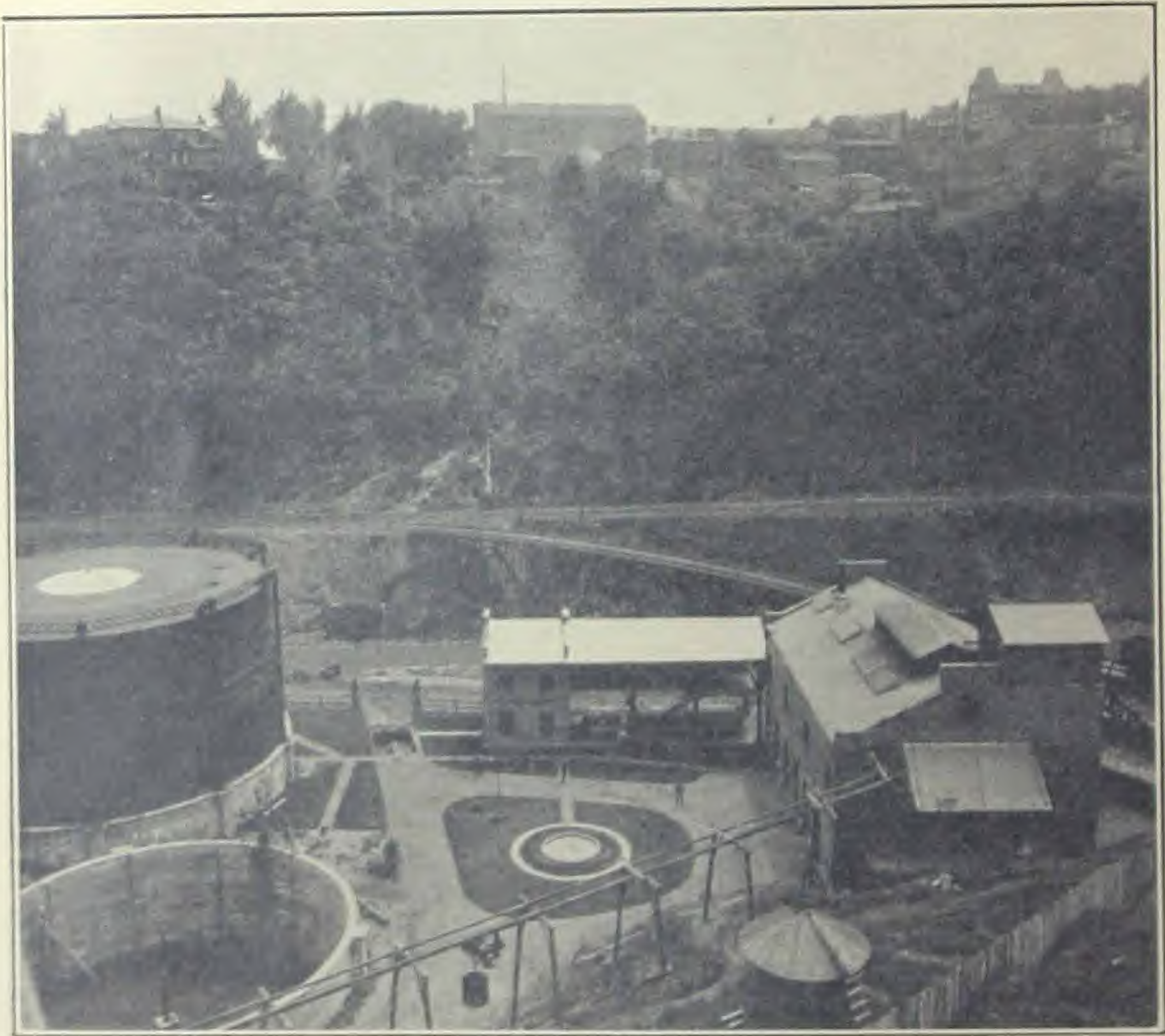


FIG. III. VIEW OF WORKS FROM THE WESTWARD.

On this property the proposition was to construct a plant that would meet the following conditions :

- Capacity of 250,000 feet daily, now.
- Capacity of 600,000 feet, in the future.
- Ability to make either coal or water-gas.
- The elimination, practically, of hand labor.
- Avoidance of any nuisance question.
- Sightliness.

How well these have been attained will appear from the photos and description following. It may be noted that the situation was



helped somewhat by the fact that stable, shop and consumer's meter space did not have to be provided for, these departments being located elsewhere in the company's properties and that having its own electric supply on a water-power basis the company was able to use electricity freely in the gas-works department.

*Retort House.*—Lynchburg is essentially a coal-gas point, the Norfolk and Western and the Chesapeake and Ohio Railroads carrying the West Virginia coals easily to it. Coal-gas was taken, therefore, as the prime process of manufacture. The retort-house is 45 feet x 72 feet 9 inches inside, of which 20 feet 2 inches is allotted to the water-gas department. Three arches for inclined retorts were installed, two benches being filled, of the Parker-Russell Mining and Manufacturing Company's make. These are benches of 6's, with retorts 12 feet 9 inches long, set at an angle of 32 degrees.

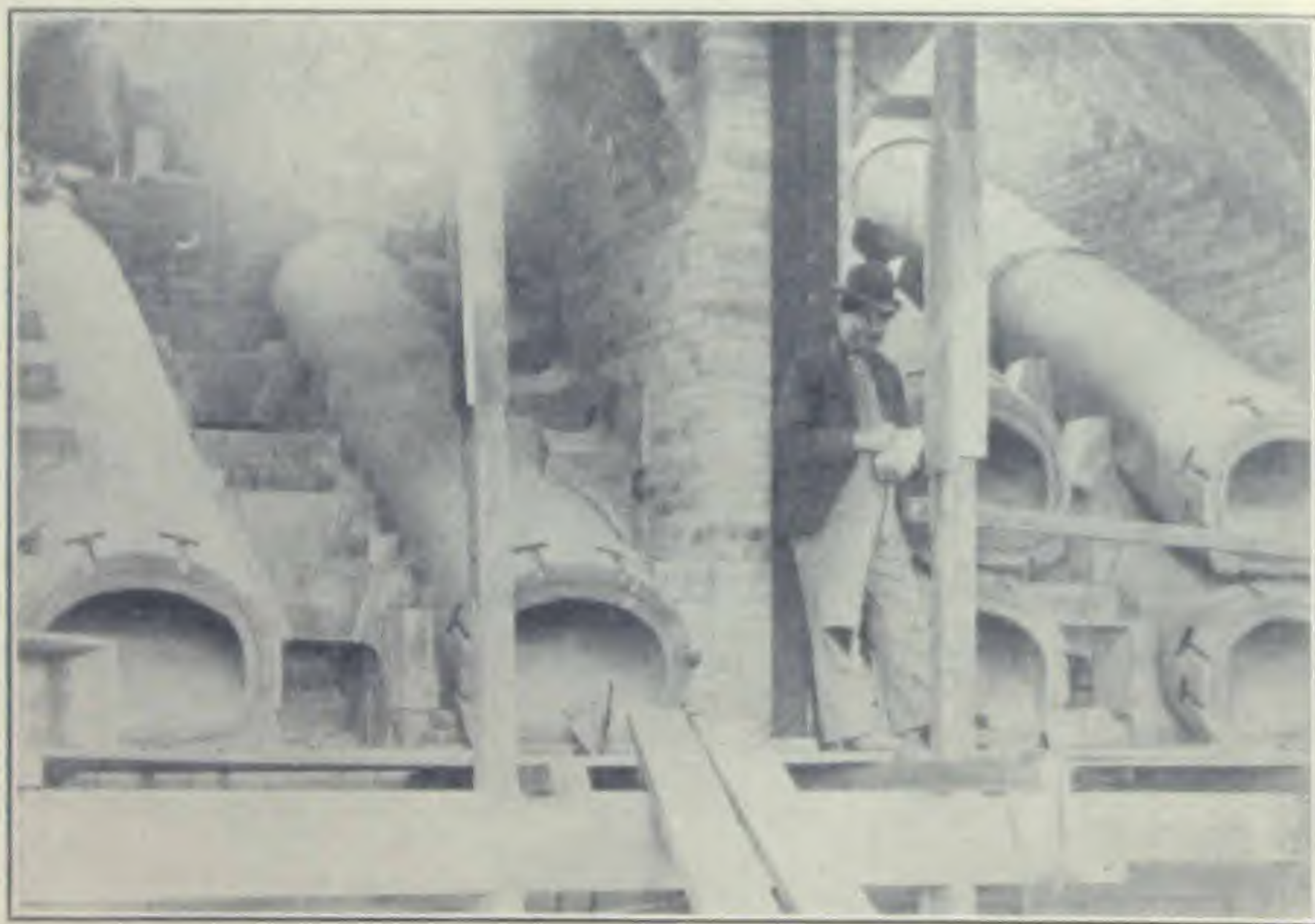


FIG. IV. INCLINED RETORT BENCH DURING CONSTRUCTION.

The cross section is a full  $\square$ , having slightly flaring sides, 15 inches high and 24 inches wide at the upper end and 26 inches at the lower. The writer was particularly desirous of—while using "inclines"—avoiding a very high building (usually necessary and found, often 50 feet from ground to eaves) and also for a long time had held the conviction that the ideal setting would be one fired by gas and with mechanical draft, to insure greater evenness of working than is found with hard fuel and ordinary chimneys. To this end the design was adopted of external producers, located outside the building, the producer-gas being led back to beneath the benches for combustion. By this means and the use of an outside (above the roof) coal bunker for daily feed the building was held down to the very moderate height of 32 feet eave level above



the ground. The benches are 36 feet 6 inches over all, 24 feet from foundation to top of brick work, 10 feet 10.5 inches through and have 22-inch partition and 44-inch end walls. The arches are 8 feet 6 inches wide, the upper or charging floor is 12 feet 4.5 inches above the first or drawing floor, which is 2 feet above the ground level. There is no cellar or pit whatever. The retorts discharge

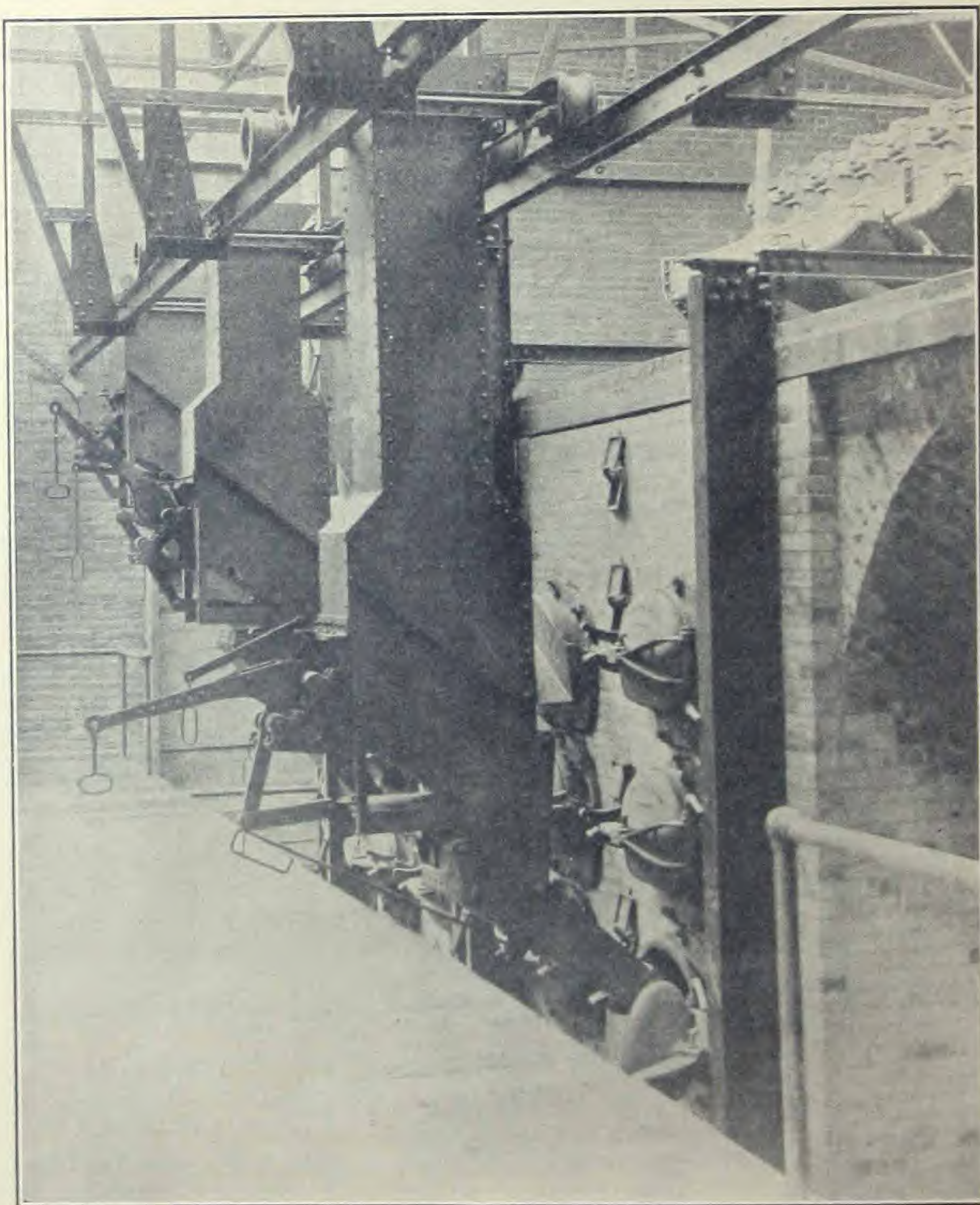


FIG. V. INCLINED RETORT CHARGING APPARATUS.

at the ordinary height above the ground floor. The ironwork is of the usual high-grade bench type; the stand-pipes are 7 inches diameter and 15 to 21 feet long. The buckstays are 12-inch.

These benches were put in operation and have operated uniformly and continuously since and from the start, early in May



without the slightest difficulty or trouble of any sort. The yield and candle-power are slightly higher than with the same coal on the old horizontal retorts and there has been an entire absence of stopped stand-pipes, irregular heats, excessive cleaning and the troubles that have been found in "whipping into shape" other

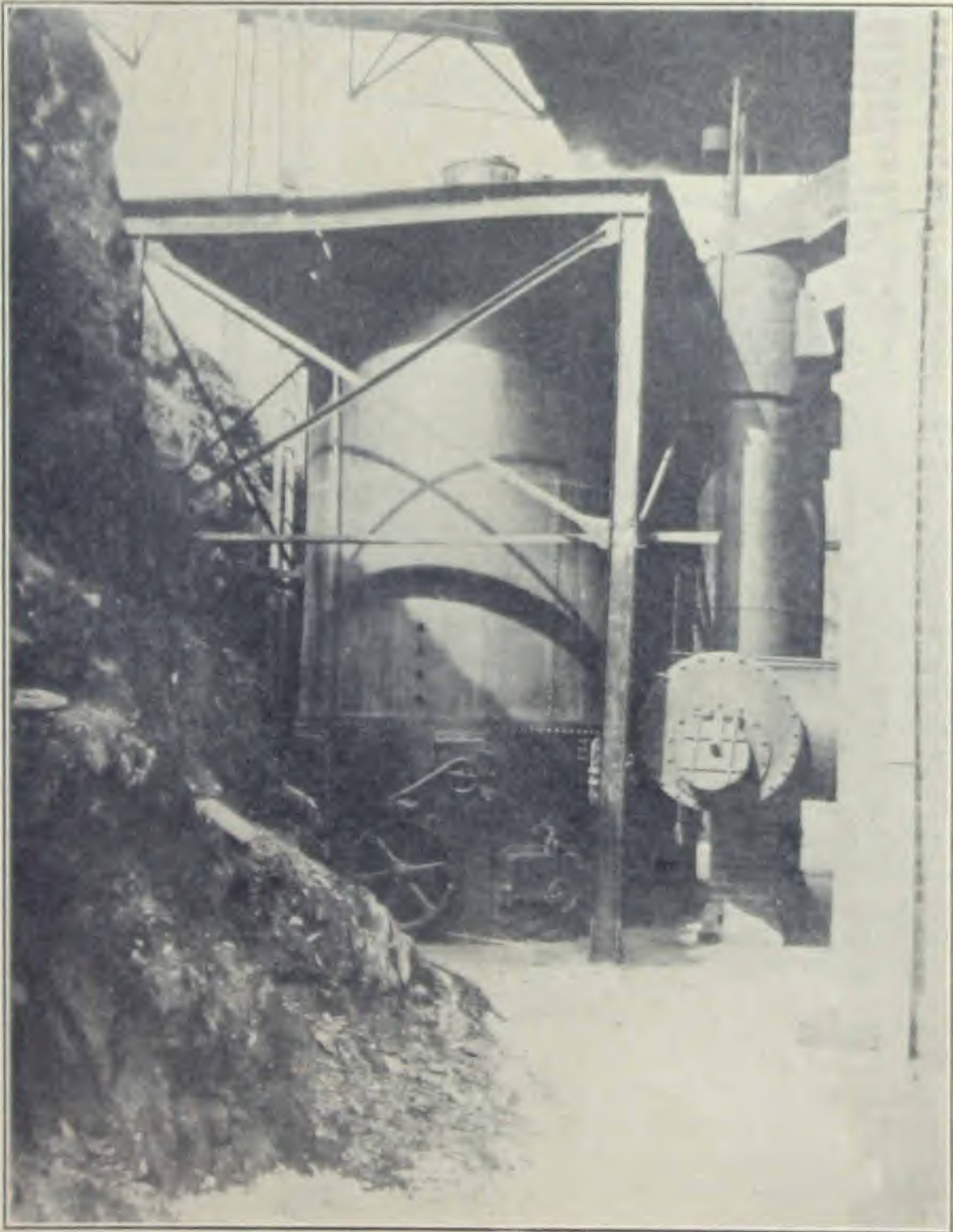


FIG. VI. TAYLOR PRODUCERS FOR HEATING RETORTS.

inclined installations in the United States. When it is remembered that this is a design without precedent heretofore and that it is the first setting of inclines built by this maker and that the Lynchburg Company's employees were totally unfamiliar with such equipment, this smooth working is extremely creditable. With Tom's Creek



(West Virginia) coal the yield has been about 4.8 feet per pound, with 4-hour charges and 450 pounds per charge; candle-power 18.25 by the bar photometer, no enrichment. The make per bench is about 75,000 feet per day; two men per shift cover all the work of taking coal in, operating the benches and producers and removing coke and, in fact, operate the entire works, even to cutting the grass, there being no others on the works' payroll.

The two gas-producers are of the "Taylor" type, 7 feet diameter by 15 feet high, the two being connected to the benches by a wrought-iron gas-main, 32 inches diameter, with a 12-inch feed to each bench. The two are located outside the gable wall of the retort house and have a rain canopy overhead but are otherwise in the weather. One will operate two benches and when running to best advantage requires about one-third of the coke made. The control of heat on the benches is perfect, any desired heat being easily maintained. This amount of coke and the labor involved is not less than would be needed for horizontal retorts, on the present small daily make, which is from 75,000 to 125,000, but the equipment was put in on the lines described, with the coal-conveying machinery, etc., to lessen the hard manual labor ordinarily involved in retort-house work and for growing future outputs without corresponding increase of labor.

A further unusual feature is the use of mechanical draft or exhaust. A fan driven by a small electric motor draws from the bench flues as well as the boiler and discharges into a 30-inch iron stack 34 feet high, just enough to clear the eave line. The purpose of this fan is to obtain a more even draft on the benches than the fluctuating wind and atmosphere conditions permit. It is believed that the extremely smooth running described and excellent results obtained quite bear out the idea of gas-fired benches and mechanical draft being the true plan for working where possible.

*Water-Gas Plant.*—Adjoining the benches but separated by partition wall is a room 20 feet 2 inches x 34 feet 8 inches, containing the fire-brick shells of a 7-foot set of the United Gas Improvement Company's standard Lowe water-gas apparatus. The fan for this is driven by an electric motor, belting direct; a very compact arrangement, doing away virtually with the space required for usual engine room and countershaft. This set has abundant capacity (in fact being lined down to 4 feet inside for present purposes), for all the water-gas that will be required for many years and as coal-gas is the normal local process, it was not thought necessary that the water-gas apparatus should be in duplicate.

The boiler of 80-horse-power, located adjoining the benches, has no special feature, excepting mechanical draft, already referred to.

*Coal Supply.*—The coal supply to the works enters on a railroad trestle some 25 feet high. The coal falls from dumping cars into a timbercoal storehouse of 1,200 tons capacity built around this trestle. Parallel to the coal house and in a trench at the ground level and snug to the bin is a Link Belt Engineering Company's 24-inch scraper conveyor, some 100 feet in length, so arranged that coal can be fed into it from various chutes



from the coal house and carried horizontally to a crusher into which it is spilled. After being crushed to about 2.5-inch size the coal falls into and is lifted by a chain-bucket elevator, extending diagonally up to the outside of the roof of the retort

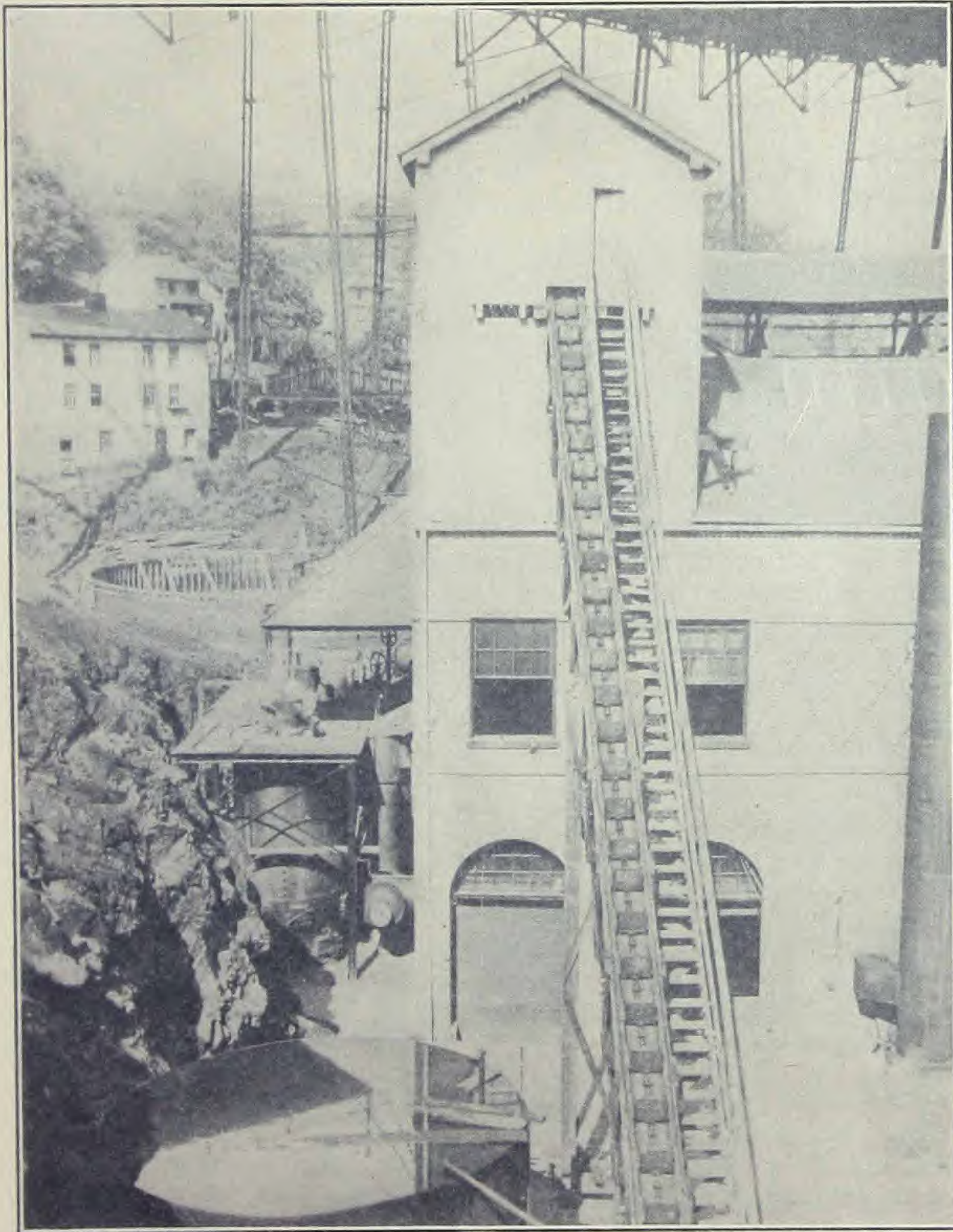


FIG. VII. OIL TANK AND BUCKET ELEVATOR DELIVERING COAL TO RETORT HOUSE.

house. Here the coal falls into a plank bin (about 14 feet square, iron lined), holding about two days' supply and from this bin it is drawn from beneath into the measuring hoppers by the men on the charging floor of the retort house.



The coal conveying, crushing and lifting machinery is operated by three 7-horse-power electric motors and is only run an hour a day every other day.

*Coke Handling.*—The coke comes easily from the retorts by gravity, without pushing or especial assistance, in large lumps, with but little breeze. After quenching it is hoisted in a dumping bucket holding 25 bushels, by a wire cable on a small drum, operated by an electric motor attached to a trolley overhead, running on a fixed 6-inch rail. This rail extends to the producers, to the water-gas room and to the coke pile and the trolley has a seat or cab for the man to ride on. As a result, the coke is electrically hoisted some 20 feet and is then electrically carried around on the single track overhead trolley rail and dropped at the point desired. No particular coke crushing or binning facilities have as yet been provided.

The exhaustor is of the Green No. 4 type, made by the Wilbraham-Green Blower Company, removed from the old works and without special feature.

*Scrubber and Condenser.*—After the gas is made it goes, if water-gas, into a 56,000 cubic foot single-lift relief holder (removed and rebuilt from old works), 20 feet x 60 feet, in concrete tank and thence is drawn through a tray-and-coke vertical cylindrical scrubber 6 feet x 20 feet, of usual type and thence through a tubular water condenser that at one time was a 72-inch steam boiler. These vessels are located outdoors, against the gable wall of generator room, with rain canopy only. The climate of Virginia and the gorge-protected location of the works permit this outdoor location, where such would not be permissible under more vigorous surroundings.

*Purification.*—The purifiers are three in number (one-half of an ultimate set of six), 12 feet x 12 feet x 7 feet each, set half below, half above the ground level. They are of concrete throughout, with 6-inch walls, reinforced with 3-inch expanded metal. They were built on the spot by the superintendent. The covers are of the dry-seal type, a rubber gasket and clamps forming the joint. There being not a yard of space to needlessly use in the works, the design was adopted of revivifying overhead. The purifiers are covered by a pavilion 22 feet 6 inches wide by 46 feet 6 inches long and 24 feet high, made of the six round columns from one of the old work's holders. At a level of 13 feet up 12-inch I-beams were thrown across to carry an oxide floor, which is made of concrete 4 inches thick, forming one large water-tight tub (the concrete being carried up the sides about 15 inches), about 20 feet x 44 feet.

The oxide is shoveled by a man in the box into a bucket, which is electrically hoisted vertically (through a hatchway in the oxide floor) to the upper level. The bucket is carried on a trolley running on a 6-inch I-beam and can be pushed where wanted. The oxide is returned to the box by a spout through any hatchway. The boxes are operated by a valve system whereby the order can be reversed, the gas be subdivided into lesser streams and the gas pass either up or down through each bed of oxide.



The station meter, 7 feet diameter, with ordinary drum, removed from the old works, in a room 18 feet 10 inches x 21 feet 4 inches, presents no unusual feature.

*Holders.*—The main storage holder is 200,000 feet capacity, of two-lift form, by Davis & Farnum Manufacturing Company. The works connections and the holder inlet are 12-inch. The outlet is 16-inch. The tank of this holder (as well as the relief holder) is unusual in being a concrete monolith. It is 83 feet diameter by 20 feet 9 inches deep; 10 feet 9 inches is below ground, 10 feet is above. There is no embankment. The wall is reinforced with 3-inch expanded metal, bedded in the walls and with rings of 60-pound railroad tee rails every four feet. The concrete portion below ground

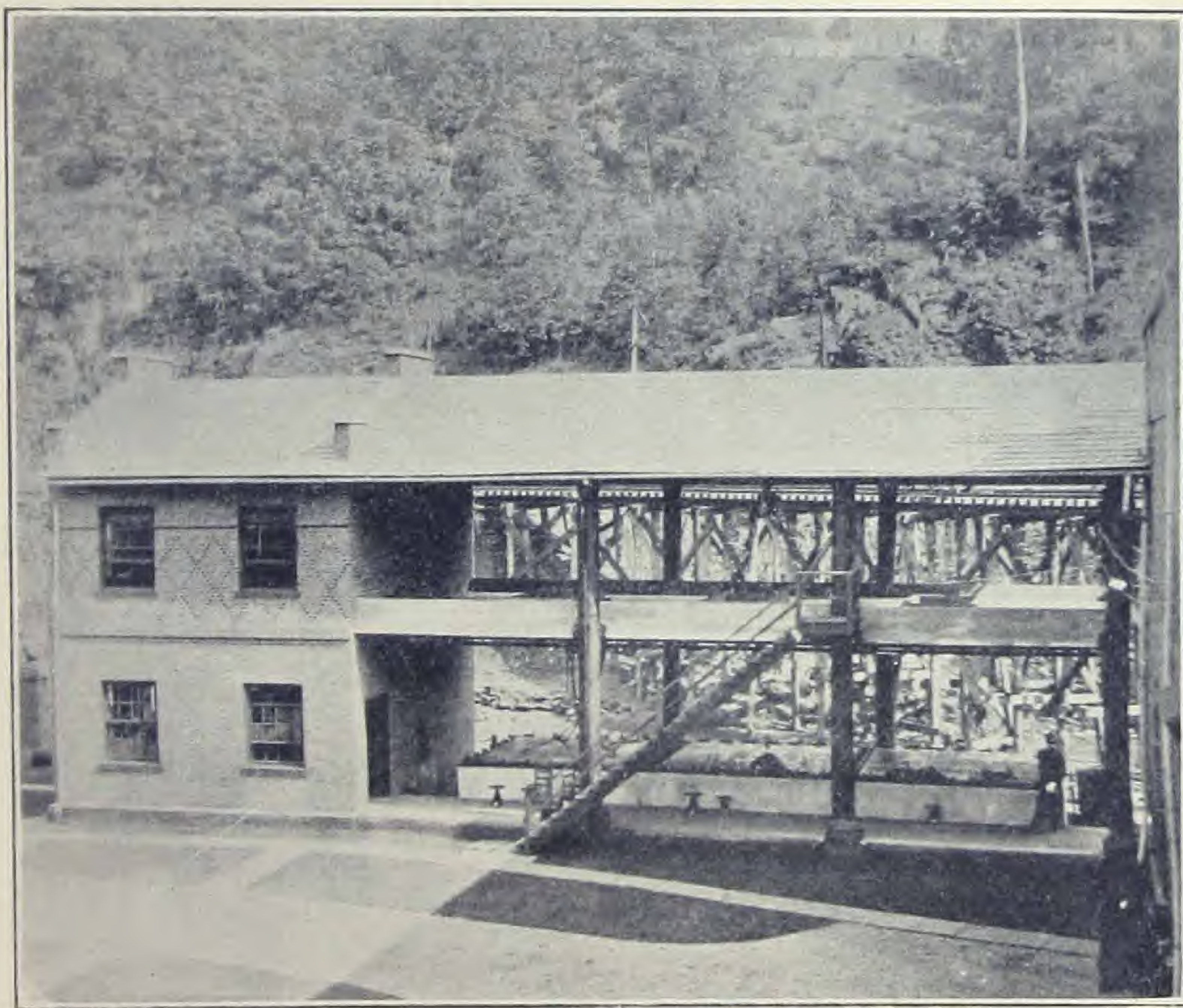


FIG. VIII. VIEW OF CONCRETE FLOOR PURIFIER HOUSE AND OFFICE.

is 16 inches thick, above the ground it is 12 inches thick and finishes with a 2-inch overhang forming a 14-inch walk-around. Pilasters 2 feet square occur at six points to afford footings for the columns of the holder guide frame. These tanks were built locally by the superintendent, with suitable moulds and concrete and were adopted as something that could be built at once on the spot and at a less cost than steel tanks as then figured. The first one, finished November 1, 1903, withstood the severe winter of 1903-4 perfectly and appears, as expected, to be of everlasting and satisfactory character. Its tightness is shown by the fact that excess water, from rainfall, has had to be twice siphoned out.



With a view to minimising pipe runs, economising space and harmonising with the holder tank, the governor house 7 feet x 12 feet was built of concrete, with walls 4 inches thick against one side of the holder tank. In this is a Connelly 12-inch governor, following, tandem, a 12-inch balance governor.

*Pipe Conduits.*—A characteristic of the works is the adoption of a conduit system, to avoid small pipes rambling around the premises. Only the 12-inch gas mains are buried in the earth. All small pipes and wires—oil, water, steam, gas lighting, pressure, tar, drainage, electric, telephone, etc.—are carried in conduits that intersect the premises. These conduits are built of cement, about 30 inches wide and 18 inches deep, slightly graded for surface drainage and are covered by plain cast-iron plates at the ground level, forming, moreover, excellent walk-ways in wet weather. Lifting the plates gives immediate access to all pipes.

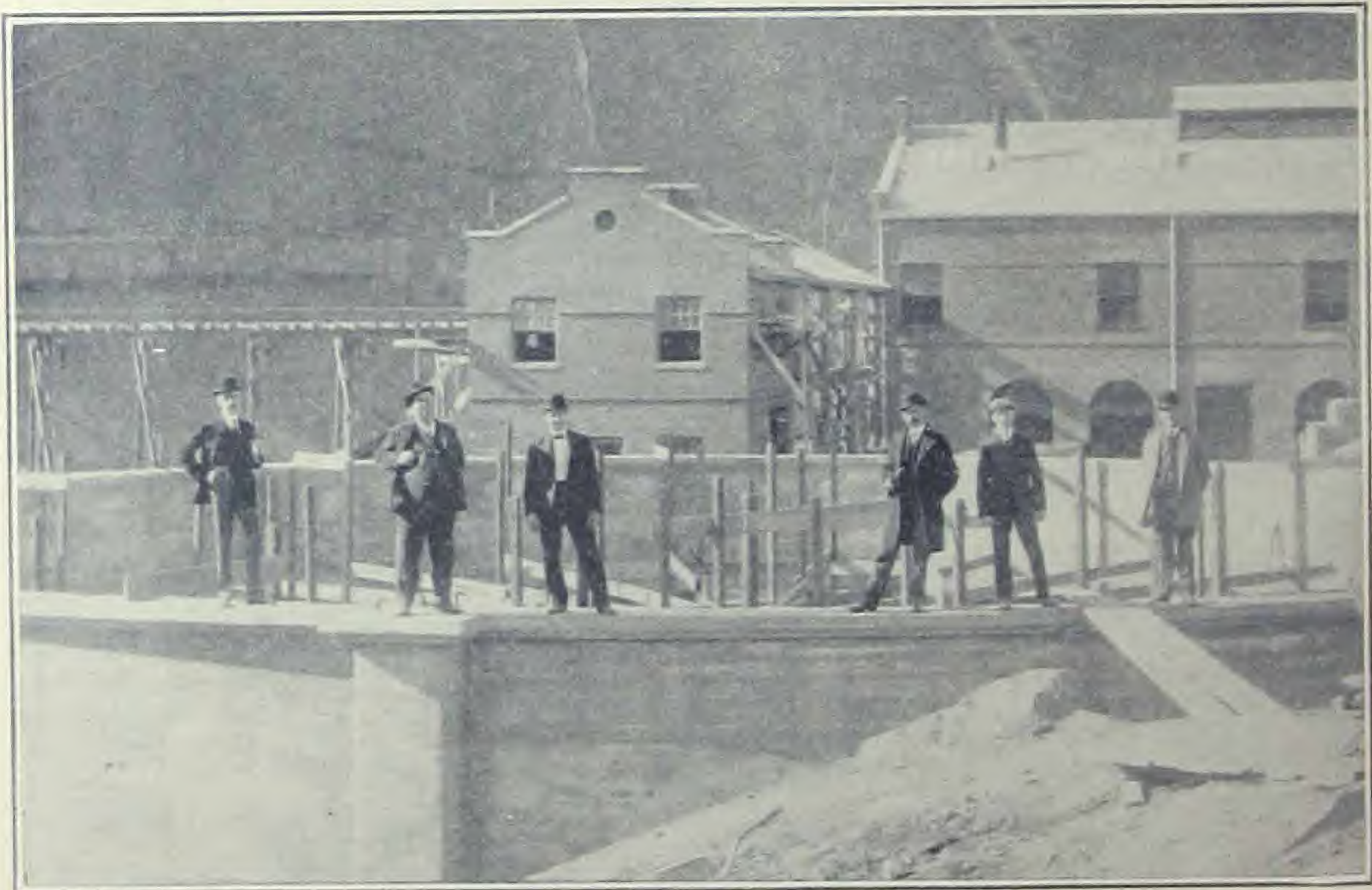


FIG. IX. CONCRETE HOLDER TANK.

*Other Features.*—The premises are lighted by electricity and gas, as best suited to the different parts. Drainage is filtered by two intercepting cast-iron tanks, made of the purifier plates from the old works. A private water supply is obtained from an 8,000-gallon tank on the hillside. A men's room is provided, wherein lockers and sanitary conveniences are available. Rolling steel doors are provided at the retort-house doors, that in warm weather enable throwing open a large wall section for coolness. Skylights make the building lighter than usual. A large room 18 feet 10 inches x 21 feet 4 inches over the meter room forms the superintendent's office, laboratory, photometer and drafting room. A 30-inch outside clock serves the premises.

It is believed that as a whole the plant is as practical and



efficient as it is possible to construct and the best of its size on the Atlantic seaboard in the South and that (despite no money having been spent for ornamentation), with its attractive gateway, cinder walks, well-kept lawn, fountain and coke and tar being screened by the buildings, it compares favorably in neatness and sightliness with many plants of far more size or pretension and easier surroundings and that manufacturing now at a minimum of cost the advantages of its design and labor-saving machinery will increase as output increases.

The plant was designed by the writer as engineer for the company and its construction was admirably carried out by R. D. Apperson, president and C. C. Hogshead, superintendent, both of Lynchburg.

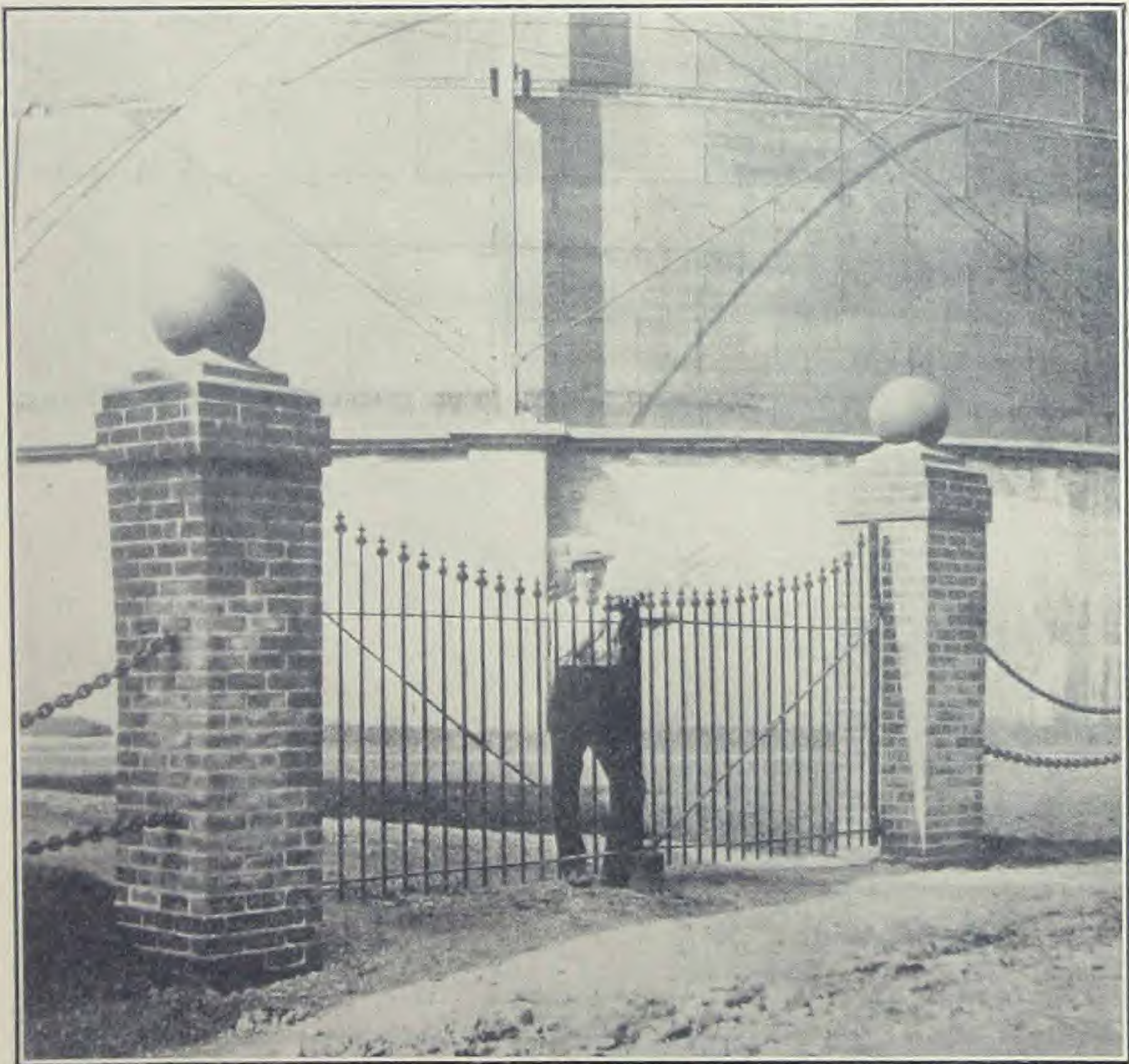


FIG. X. ENTRANCE TO WORKS AND ITS SUPERINTENDENT.